

Episodic Memory: A Neglected Phenomenon in the Psychology of Education

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Contemporary educational psychology has employed models of procedural and semantic (or declarative) memory, but generally it has ignored a third form of memory (i.e., episodic memory) thought by some (e.g., Tulving, 1983, 1985) to be especially important for explications of human functioning. Tulving's (1983, 1985) ternary theory of memory is presented, with emphasis given to the acquisition, representation, and expression of knowledge in episodic memory. I argue that studies of pupils' episodic memories, their characteristics, and their functions may enhance the power and relevance of educational psychology with respect to understanding how pupils learn from instruction in classroom contexts. A conceptual framework and possible strategies for the conduct of instructional research are described that consider pupils' episodic memories as important mediating variables in learning from teaching.

Contemporary educational psychology places considerable emphasis on understanding how pupils learn from teaching. Work in this area has potential to link pupils' phenomenal accounts of their learning with more formal accounts of classroom teaching and learning that arise from psychologists' analyses. In this article, I argue that existing analyses of pupils' learning from instruction may benefit from the addition of an explicit focus on pupils' episodic memories of teaching and learning.

THE NEGLECT OF EPISODIC MEMORY

Cognitive psychologists (e.g., Ashcraft, 1989; Klatsky, 1980) have emphasized two basic distinctions with respect to human memory. One of these

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distinctions is that between *declarative* and *procedural* memory. Declarative memory is considered to be memory for basic facts, concepts, and propositions. Procedural memory is memory of how to do something, including various mental procedures and psychomotor skills. The second distinction is that between *semantic* and *episodic* memory. Semantic memory contains a person's general knowledge, including knowledge of language. (Most cognitive psychologists generally equate semantic with declarative memory.) Episodic memory contains an autobiographical record of personal experiences particular to an individual. It is the kind of memory that is involved in remembering past events. According to Tulving (1983), who is the leading proponent of episodic memory as a separate system distinct from procedural and semantic memory, episodic memory "is the form most familiar to the proverbial man on the street, yet it has received little direct attention from psychologists or other scientists" (p. 1).

Educational psychologists have made rather extensive investigations of semantic (declarative) and procedural memory with respect to studying and theorizing about classroom learning and teaching. Studies of learners' and teachers' declarative and procedural knowledge, strategies, memories, and cognitive structures are well represented in contemporary journals and texts in educational psychology (e.g., Dembo, 1991; Gage & Berliner, 1991; Lesgold & Glaser, 1989; Pressley & Levin, 1983a, 1983b). In contrast, very little theoretical or empirical work has been conducted in educational psychology that has examined the episodic (experiential and autobiographical) memories of teachers and learners in relation to instructional interventions and students' learning from such interventions. Leading textbooks in educational psychology either fail to mention episodic memory at all (e.g., Woolfolk, 1990) or do so in a brief, cursory fashion (e.g., Dembo, 1991; Gage & Berliner, 1991) prior to moving on to a more extensive treatment of extant work on declarative and procedural memory and knowledge.

Why have applied cognitive psychologists working to understand teaching and learning in classroom and related settings tended to ignore the study of episodic memory? (Exceptions include work by Smith & Rothkopf, 1984, and a few recent research programs mentioned later in this article that have studied episodic memory phenomena almost incidentally while pursuing other lines of inquiry.) After all, similar psychologists at work in areas such as applied social, personality, and therapeutic psychology recently have begun to undertake studies of individuals' experiential, autobiographical memories. Such studies attempt to enhance our understanding of such phenomena as individuals' memories for the names and faces of previous acquaintances (e.g., Bahrick, Bahrick, & Wittlinger, 1975), the accuracy of witnesses' reconstructions of their experiences of crime (Loftus, 1979), the "flashbulb" memories of college students for significant events (e.g., the assassination of President Kennedy), and the nature and functions of

clients' recollections of specific events in psychotherapy (Martin & Stelmaczonek, 1988).

It seems possible that the relative absence of studies of episodic memory in educational psychology may relate to a tendency to consider such memories to be less educationally significant than semantic or procedural memories. Such a possibility is supported by statements like those of Estes (1989) in his relatively recent review of cognitive learning theory and research in the psychology of education:

Presumably, most learning that occurs in educational settings has to do with semantic memory and has a cumulative character as distinguished from the memory for discrete events that characterizes episodic memory. Episodic memory appears to enter educational learning mainly as a stage or component in more complex processes, as, for example, memory for particular exemplars of categories in concept learning or memory for the outcomes of particular actions in skill learning. (p. 5)

Estes implied that to focus on episodic memory in educational research concerned with learning would be a mistake because of the ephemeral nature of such memories and their relative unimportance when set against the semantic (conceptual) or procedural (skill) learnings that result from numerous episodic experiences with the content or procedures to be learned. Slavin (1991, p. 139) elaborated on the possibly transient nature of much episodic memory when he said, "Episodic memories are often difficult to retrieve because most episodes in our lives are repeated so often that later episodes get mixed up in memory with earlier ones, unless something happens during the episode to make it especially memorable."

Nevertheless, the transitory nature of cognitive processes or operations (e.g., encoding, rehearsal, retrieval, etc.) has not prevented educational psychologists from spending considerable effort on their study (cf. Pressley & Levin, 1983a). Something more must be at work. It is entirely possible that the potential utility of studying episodic memory in applied psychological research in education has been obscured by the generally insignificant, largely trivial character of many of the learning tasks examined by cognitive psychologists (including many educational psychologists) in laboratory or other highly controlled settings. It is difficult to imagine that participants in this research would be motivated to attend to or find particular significance in their own experiences in learning the kinds of routine, detached information typically embedded in the relatively uninspired tasks most often set by experimenters in such settings. In these settings, the likelihood that "something happens during the episode to make it especially memorable" (Slavin, 1991, p. 139) is probably extremely small.

However, natural classroom contexts and the experiences of learners and

teachers within them can be expected to differ dramatically from the laboratory, simulated, or analogue contexts in which much research on human learning is conducted. In particular, the personal significance and memorability for individual learners of particular events that occur in regular classroom settings can be expected to be much greater than for events experienced in these other settings. In fact, it is extremely common to converse with individuals who, quite unprompted, appear to recall very specific events from their educational and school experiences in vivid and compelling detail many years after such events are reported to have occurred. I often begin my introductory courses in educational psychology by asking students to recall specific events from their own educational experiences. Vignettes like the following are legion in their responses.

Learning does not have to be difficult because a concept is hard to grasp. My own introduction to the world of negative numbers in Grade 7 is quite memorable. Our teacher used white ants (white chalk bugs on the board) for positive numbers and black ants for negative numbers. Over the week the ants proceeded to show us what happens when either a white or black ant crossed the line to the other side.

The study of episodic memory for specific classroom events constitutes a potentially important focus for research in educational psychology, one that has previously been neglected. Perhaps the most important theoretical argument in support of the empirical study of learners' specific episodic memories concerns their possible mediational nature and function. Unlike semantic and procedural memories, episodic memories are not conflated with knowledge *per se*. In the general literature in educational psychology, the terms *memory* and *knowledge* are used almost interchangeably with respect to declarative and procedural information. With respect to these systems, what one knows is what one remembers. This sort of conflation does not hold for episodic memory. Autobiographical memory for specific events that one has experienced is very close to the ordinary language, everyday use of the word *memory*. Episodic memories of this sort stand apart from whatever their knowledge yield may be.

Understanding, insight, confusion, or enlightenment may be associated with episodic memories, but these factors are not constitutive of episodic recall *per se*. Thus, as a university freshman, my knowledge of Newton's second law may have been enhanced permanently by my witnessing a laboratory demonstration in which small lead pellets and balls of cotton descended at comparable rates in total vacuums. However, my knowledge of Newton's second law stands apart from my episodic recollection of that particular laboratory demonstration. The critical point is that episodic memory is not conflated with knowledge, as are other types of memory

studied more frequently by educational psychologists. Consequently, episodic memory can be viewed conceptually as a true mediator, acting to mediate between instructional, classroom events and learners' knowledge, skills, and attitudes acquired as a result of participation in those events.

At least some extant empirical work in educational psychology has examined pupils' episodic recall of instructional events, although seemingly incidental, and without explicit labeling as such, or recognition of the sort of mediational role envisioned here. Instructional research in areas such as mnemonic elaboration strategies (e.g., Pressley & Levin, 1983a) and conceptual models (e.g., Mayer, 1989) has emphasized learners' active construction and participation in learning experiences and their recall of targeted aspects of those experiences (e.g., the elaboration methods or conceptual models employed). However, the primary emphasis in such work has been on the acquisition of procedural or declarative information. Any probing of learners' episodic memories is quite incidental.

A similar lack of episodic focus is apparent in more qualitative analyses of pupils' misconceptions, particularly with respect to the learning of important ideas and procedures in science and mathematics. Such work indicates, among other things, that children frequently construct calculation procedures or conceptual understandings on the basis of examples that do not adequately constrain their constructions (e.g., VanLehn, 1985). Consequently, they invent incorrect procedures and understandings such as buggy algorithms or malrules (cf. Resnick, 1989). Now it seems clear that children must construct such malrules on the basis of specific experiences with particular examples in specific teaching-learning contexts. However, work of this kind has emphasized analyses of current manifestations and possible ameliorations of students' malrules and misconceptions. None of these studies has focused specifically on learners' episodic memories of their experiences in coming to construct malrules or their experiences in learning to give up malrules and adopt more appropriate procedures and conceptions.

Work by Nuthall and Alton-Lee (1990) probably comes closer to the type of research I advocate in this article than any other empirical work in educational psychology. Nuthall and Alton-Lee reported detailed case studies of students' attitudes, perceptions, and memories of unit content that they set against a variety of aggregated, group data to provide extremely thorough accounts of pupils' learning from teaching. Although their focus was still primarily on procedural and declarative content, Nuthall and Alton-Lee (1990) were explicit in their consideration of the possible importance of pupils' episodic memories. Some of the potential of pupils' episodic memories to provide a more experiential, personalized account of classroom learning is apparent in the episodic data from individual pupils collected by these researchers.

I got a bit confused, you know, with subway and Broadway. . . . I think that one reason why I might be a bit confused is it came up in the unit all at once, the street signs, Broadway, and subway, and I think it didn't sort of register which each were. . . . Yeah, I think it all came in the sort of same time. (Nuthall & Alton-Lee, 1990, p. 564)

TULVING'S TERNARY THEORY OF MEMORY

Tulving (1983) posited the existence of three separate memory systems: (a) procedural memory, (b) semantic memory, and (c) episodic memory. The three systems are related to each other in that procedural memory (the most developmentally basic or foundational form of memory) "contains semantic memory as its single specialized subsystem" (Tulving, 1985, p. 387). "Semantic memory, in turn, contains episodic memory as its single specialized subsystem" (p. 387). Each more specialized memory system depends on (and is supported by) the more general, more foundational systems or system. However, each of the more specialized memory systems possesses capabilities not possessed by the more general systems. Thus, although semantic memory is a subsystem of procedural memory, it is a subsystem that envelops and encases the foundational procedural system. Similarly, episodic memory envelops and encases the semantic system.

Tulving made it very clear that each successive memory system is characterized by unique capabilities not possessed by the more foundational system(s). In Tulving's (1985) own words:

Procedural memory enables organisms to retain learned connections between stimuli and responses, including those involving complex stimulus patterns and response chains, and to respond adaptively to the environment. Semantic memory is characterized by the additional capability of internally representing states of the world that are not perceptually present. It permits the organism to construct mental models of the world . . . models that can be manipulated and operated on covertly, independently of any overt behaviour. Episodic memory affords the additional capacity of acquisition and retention of knowledge about *personally experienced events* [italics added] and their temporal relations in subjective time and the ability to mentally "travel back" in time. (p. 387).

In particular, note that episodic memory alone is specialized with respect to the acquisition and retention of experiential knowledge.

Mental representations in procedural memory essentially consist of propositions that link various actions to conditions with which they are associated. The procedural memory system thus provides blueprints for



future action without really containing any explicit information about the past (Dretske, 1982). Representations in the semantic memory system contain propositions that describe the world without prescribing any particular actions or taking any particular attitude with respect to these descriptions. The important points to note are that representations in both the procedural and semantic systems are ahistorical, depersonalized, and generally similar in content to the information they represent (Dretske, 1982).

In a way that is quite distinct from the other two memory systems, the information contained in episodic memory goes beyond representations of condition-action rules and declarative propositions to include relations of this information to the rememberer's personal identity. For example, my procedural memory for statistics enables me to calculate a *t* test for differences between two means. My semantic memory for statistics allows me to understand that the standard error for such a test is the standard deviation of the random sampling distribution that consists of a normally distributed frequency curve of differences between means of the type I am considering. However, it is my episodic memory that relates such procedural and semantic information to my own experiences as a learner (statistics student), teacher, and researcher. I still recall rather vividly the statistics class (the chalkboard illustrations and some of the exact words spoken) during which I first understood how a random sampling distribution differs from a simple frequency curve plotting raw scores. My episodic memory includes my recollection of the personal sense of relief and excitement that accompanied this new understanding, together with a metaphoric image of the doors from descriptive to inferential statistics opening for me, and my walking through them with newly found confidence.

The episodic memory system is unabashedly subjective in much of its content and in the framing of this content within subjective time and space (Tulving, 1983). Clearly, some aspects of episodic information may be associated with condition-action rules or semantic propositions. However, much of the subjective, affective content in episodic memory may be represented in more imaginal codes. Candidates for basic representational units in episodic memory include the "imagens" of Paivio (1986) and the "emotion nodes" of Bower (1981).

Only direct, nonreflective expression of knowledge is possible in procedural memory. Relatively rigid condition-action rules generally restrict the expression of procedural knowledge to formats determined at the times these rules were acquired. On the other hand, acquired knowledge in the semantic memory system can be expressed more flexibly in different behavioral forms and under conditions quite removed from those of

original learning. However, such flexibility in knowledge expression is still governed by relatively formal rules concerning patterns of association and activation within relevant declarative, propositional networks.

Flexibility in knowledge expression also holds true for acquired knowledge in episodic memory but much more so. The mode of knowledge expression in episodic memory is a form of recollective and/or projective experiencing that is thought to be associated intimately with the attitude of the knower (cf. Bartlett, 1932; Tulving, 1983, 1985). What this means is that information in episodic memory can be reflected on in a self-conscious manner capable of temporally bridging the past, present, and future. Although self-reflection on the contents of semantic memory also may be possible, self-reflection on episodic content inevitably involves self-reflection on one's self as a learner, knower, or rememberer. Episodic memories for past experiences can be recollected and projected forward in time to inform and motivate current and future courses of action, especially if personal attitudes associated with the recollections are conductive to such projection.

As should be clear by now, the kind of consciousness associated with episodic memory is highly distinctive from the forms of consciousness associated with the procedural and semantic memory systems. Procedural memory is associated with *anoetic* (nonknowing) consciousness. Anoetic consciousness refers to an organism's capability of sensing and reacting to external and internal stimulus patterns. Semantic memory is associated with *noetic* (knowing) consciousness. Noetic consciousness refers to an organism's knowledge of its world. It makes possible an introspective awareness of both internal and external worlds. Episodic memory is associated with *autonoetic* (self-knowing) consciousness. As implied earlier, this sort of consciousness involves the personal awareness of a knower of: "his or her own identity and existence in subjective time that extends through the present to the future. It provides the familiar phenomenal flavor of recollective experience characterized by 'pastness' and subjective veridicality" (Tulving, 1985, p. 388).

In his writings, Tulving (1983, 1985) presented numerous conceptual and empirically based arguments attesting to the existence of episodic memory as separate and distinct from procedural and semantic memory systems, including a comprehensive rendering of related arguments by others (e.g., Wood, Ebert, & Kinsbourne, 1982). Interested readers are directed to these sources for details of Tulving's defense of his theory. However, a brief description of some empirical work by Tulving, Schacter, and Stark (1982) should convey the nature of the empirical support he offered for a separation of episodic from semantic memory.

Tulving et al. (1982) compared recognition memory and fragment completion (a form of prompted recall) responses of subjects who 1 week

previously had "learned" lists of work. Results indicate stochastic independence between scores on the recognition task (a task requiring recall of a specific learning episode) and scores on the fragment completion task (a task requiring much less, if any, recall of a specific learning episode). Such separation in task scores may be interpreted to imply a similar separation in the memory systems that are theorized to undergird responses to the different tasks. Tulving (1985) reported three other experiments yielding similar results. He also offered (in both Tulving, 1983, and 1985) additional evidence for the separation of episodic and semantic memory systems that arises from numerous clinical studies conducted with brain-damaged individuals who can acquire semantic knowledge with seemingly no ability to recall the learning episodes during which such knowledge was imparted (e.g., Gilsky, Schacter, & Tulving, 1984).

POSSIBILITIES FOR INSTRUCTIONAL RESEARCH

Applied to education, Tulving's (1983, 1985) characterization of episodic memory forces attention to the individual, subjective nature of students' learning experiences in classrooms. Thus, procedural and declarative information about reading, mathematics, social studies, music, science, and so forth is filtered through and coexists with students' episodic memories of personal learning experiences in these subject areas. Such experiential information is likely to be stored in episodic memory with highly individualized attitudinal, motivational, and affective colorations. (See Bower, 1981, for a discussion of possible representational patterns of this sort.)

For example, I recently helped my daughter, then in Grade 2, learn to do simple addition with regrouping. Kara made such computations correctly until she was required, when adding 3 one- or two-digit numbers, to carry more than a single 10 to the 10s column. Under such circumstances she would not carry a 20 or 30 to the 10s column, but would persist in carrying a single 10. When asked about her actions, she readily explained that "you carry 10s to the 10s column not 20s or 30s. It is the 10s column, not the 20s column." With the help of instructional materials that depicted single rods and bundles of 10 rods each, single cubes and piles of 10 cubes, and actual rods and cubes, Kara and I spent 1 or 2 hrs "correcting" her misconception. Today, Kara demonstrates satisfactory procedural and semantic knowledge with respect to addition with regrouping. However, she also exhibits episodic recall of how we "figured it out" and says that her memory of "the sticks and squares" helps her to understand that "carrying 20 really is carrying two 10s."

The relation envisioned between episodic memory and procedural/declarative knowledge is a mediational one in which a learner's episodic

memories for particular instructional events mediate important revisions to relevant procedural/declarative knowledge structures. It also is the case that a learner's existing (preinstructional) procedural and declarative knowledge may play an important role in determining what instructional-learning events are retained in the learner's episodic memory. It is very likely that episodic information that is somehow inconsistent with existing procedural and declarative knowledge, yet is capable of being comprehended in the context of existing procedural and declarative knowledge, may be especially effective in mediating desired revisions in learners' procedural/declarative systems.

How may research on teaching be conducted that examines students' episodic memories of instruction and their possible mediational effects on student learning? Before outlining possible research studies and methods, I want to be clear about the conceptual model I have in mind with respect to how episodic memories of learners may mediate their learning from instruction. One way of doing so is to state explicitly the central propositions that may be examined by means of the research and methods I describe. These core propositions are as follows:

1. Human learners remember specific details of events and experiences associated with classroom teaching and learning.
2. These episodic memories mediate revisions to learners' procedural and semantic knowledge and affect the attitudes and feelings that learners associate with such knowledge.
3. Instruction can be designed and delivered in ways that enhance learners' episodic memories for instructional events and information. The rationale for these instructional manipulations is that more extensive episodic memories will mediate superior retention and use of relevant procedural and declarative knowledge as well as the strengthening of supportive attitudes and feelings.

Because the basic empirical claim motivating instructional research on learners' episodic memories is that learners in classrooms retain memories of their experiences that are much more extensive and rich (in affect, images, personal reactions) than recollections of specific declarative knowledge and procedural skills alone, a first step to testing this claim may be to undertake systematic interviewing of learners with respect to their recollections of classroom experiences. Potentially, the episodic memories of a wide range of learners for a wide variety of instructional interventions may be probed through the use of methods and instruments similar to those that already have been used to research episodic memory in other applied settings (cf. Gruneberg, Morris, & Sykes, 1988). Descriptive data from such

initial investigations can be organized into various maps and taxonomies of the variety and types of episodic memories retained by different learners at different developmental/grade levels in interaction with different subject areas and instructional approaches.

In initial work of this type, I have begun to probe pupils' episodic memories for instructional events during Grade 6 mathematics (fractions and geometry) classes. Interestingly enough, my first efforts that involved asking children after such classes questions like "what do you remember most about this math class?" failed to yield much information beyond the recollection of general or specific information about curriculum content (mostly, subject-specific procedural and semantic information about operations with fractions and geometric figures). However, when I indicated specifically that I was interested in everything pupils remembered (including specific things they heard or saw the teacher, other students, or themselves say or do), pupils' responses to my memory probes provided a wealth of information with respect to their attention to, interests in, feelings about, and reactions to classroom and instructional events. Even at this preliminary stage in my work I see potential uses of such episodic, experiential information in refining the study of academic learning time, pupil engagement/disengagement from schooling (cf. Finn, 1989), and other salient topics in research on learning from instruction.

Eventually, such descriptive work with respect to the content and nature of learners' episodic memories of instruction may be complemented by thorough analyses of forms and characteristics of instructional discourse and presentations that seem (based on analyses of students' episodic memory data in combination with tape recordings and transcriptions of instructional sessions) to render such discourse more or less memorable. My colleagues and I (Cummings, Hallberg, Martin, & Slemmon, 1992; Martin, Cummings, & Hallberg, 1992; Martin, Paivio, & Labadie, 1990; Martin & Stelmaczonek, 1988) have conducted such work on discourse characteristics associated with clients' episodic memories of counseling interventions. These studies demonstrate that clients in counseling do retain vivid memories of counseling sessions, memories that may mediate changes to clients' understanding of and ability to cope with or act on their current concerns.

Furthermore, the accuracy and specificity of such memories is highly correlated with both informal and formal measures of successful therapeutic outcome. In the study by Cummings et al. (1992), clients' episodic memories of specific therapeutic events were judged for accuracy against verbatim transcriptions of therapy sessions. The resultant measure of "episodic memory accuracy" correlated .48 with a measure of overall therapeutic improvement. Also, at the level of individual counseling sessions, clients' accuracy of episodic memories discriminated reliably between more and less successful sessions.

Finally, therapists' intentional use of metaphoric and imagery-rich language during counseling influenced the exact therapeutic events that clients recalled. In the study by Martin et al. (1992), counselors employed vivid metaphors in an intentional attempt to make "counselor-judged significant, therapeutic content" (p. 144) more memorable to clients. Results were that clients consistently recalled a high proportion of counselors' intentional use of metaphor and rated sessions during which they recalled counselors' intentional metaphors as significantly more helpful than sessions during which they failed to recall counselors' intentional metaphors.

Given that counseling may be viewed as a special form of one-to-one instruction, it seems reasonable to hypothesize about results from similar research conducted on pupils' episodic memories in learning from instruction. For example, to test the second previously listed core proposition, it would be important to determine if more numerous, vivid, and specific pupil memories for classroom events really do correlate significantly with pupils' scores on quizzes designed to assess increments in their procedural and declarative knowledge of lesson content, especially increments associated with important revisions to pupils' relevant conceptual understandings and theories.

At more advanced stages of research on learners' episodic memories for instruction, it is possible to imagine verification studies in which teachers may intentionally attempt to manipulate potentially memory-enhancing characteristics of their own instructional discourse and presentations to determine the extent to which such instructional "mini-interventions" may actually influence particular forms of episodic memory associated with student learning. Particular forms of such memory-enhancing mini-interventions may be tailored specifically to the presentation of pivotal ideas in different curricula to learners with unique instructional, experiential histories. For example, extensive use of appropriate levels of metaphor (stories) and imagery may be used to enhance a reluctant learner's memory for and understanding of important concepts such as addition with regrouping in Grade 2 mathematics. As mentioned earlier, a good deal of laboratory and quasi-laboratory research currently exists with respect to the effects of instructional elaboration, imagery, and other memory-enhancing variables on students' learning (Pressley & Levin, 1983a, 1983b). In addition, many curriculum theorists (Egan, 1989) have written extensively about the possible use of images, metaphors, and stories in enhancing pupils' memory for and understanding of classroom teaching. Building on such existing work by conducting episodic memory research of the kind envisioned here in real classroom contexts is an exciting prospect. Once again, Nuthall and Alton-Lee's (1990) work provides at least one example of a research program that already has benefitted from an explicit consideration of pupils' episodic memories of teaching and learning experiences.

There are, of course, several important questions about episodic memory as a mediating variable in learning from teaching that have been largely avoided in this article. One particularly important issue concerns the veridicality of episodic memories, given well-known capacities of humans to reconstruct their recollections of personal experience (Bartlett, 1932; Gruneberg et al., 1988; Tulving, 1983). Research conducted by Cummings et al. (1992) and Martin and Stelmachzonek (1988) indicated that the episodic memories of participants in counseling are reasonably veridical, at least over periods of up to 6 months. However, there seems to be little question that pupils' episodic memories for instructional events and content may be expected to undergo considerable reconstruction and change over longer periods of time, and this may be a result of repetition and elaboration of curriculum content over different courses of study and grade levels. Ultimately, questions of memorial veridicality and the effect of memorial veridicality on the mediational functions of episodic memory hypothesized herein may be examined empirically in studies similar to those just sketched. Currently, little is known about such matters.

A second issue that I hope will be clarified by empirical work of the sort I have suggested concerns the extent of episodic memory mediation. As many of the examples used in this article seem to indicate, it is probably reasonable to imagine that the learning of procedures or concepts that learners find particularly difficult or significant may be mediated by particularly memorable classroom episodes. However, a good deal of school and classroom learning may occur in a more uninspired, yet important, manner in the absence of explicitly memorable classroom episodes. In the latter case, the sort of graduated, incremental learning sequence described by Slavin (1991) well may hold—that is, relatively mundane "episodes in our lives are repeated so often that later episodes get mixed up in memory with earlier ones" (p. 139). However, when an important or pivotal concept in a curriculum is confronted, it may be that "something could happen during the learning episode to make it especially memorable" (Slavin, 1991, p. 139). In these cases, the attitudes and understandings of learners for such pivotal ideas may derive in large part from explicit episodic memories of relevant classroom events. Clearly, the extent and range of episodic memory mediation are open to determination through empirical inquiry.

ACKNOWLEDGMENTS

The preparation of this article was supported by Grant #410-91-1740 from the Social Sciences and Humanities Research Council of Canada.

Appreciation is extended to Judy Lapadat, Wyn Martin, Gavriel Salomon, Phil Winne, and anonymous reviewers for invaluable feedback on earlier versions of this article.

REFERENCES

Ashcraft, M. H. (1989). *Human memory and cognition*. Glenview, IL: Scott, Foresman.

Bahrick, H. P., Bahrick, P. C., & Wittlinger, R. P. (1975). Fifty years of memory for names and faces: A cross-sectional approach. *Journal of Experimental Psychology: General*, 104, 54-75.

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge, England: Cambridge University Press.

Bower, G. H. (1981). Mood and memory. *American Psychologist*, 36, 129-148.

Cummings, A. L., Hallberg, E. T., Martin, J., & Slemon, A. G. (1992). Participants' memories for therapeutic events and ratings of session effectiveness. *Journal of Cognitive Psychotherapy: An International Quarterly*, 6, 113-124.

Dembo, M. H. (1991). *Applying educational psychology in the classroom* (4th ed.). New York: Longman.

Dretske, F. (1982). The informational character of representations. *Behavioral and Brain Sciences*, 5, 376-377.

Egan, K. (1989). Memory, imagination, and learning: Connected by the story. *Phi Delta Kappan*, 71, 455-459.

Estes, W. K. (1989). Learning theory. In A. Lesgold & R. Glaser (Eds.), *Foundations for a psychology of education* (pp. 1-50). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research*, 59, 117-142.

Gage, N. L., & Berliner, D. C. (1991). *Educational psychology* (5th ed.). Boston: Houghton Mifflin.

Glisky, E., Schacter, D. L., & Tulving, E. (1984, August). *Vocabulary learning in amnesic patients: Method of vanishing cues*. Paper presented at the meeting of the American Psychological Association, Toronto, Canada.

Gruneberg, M. M., Morris, P. E., & Sykes, R. N. (Eds.). (1988). *Practical aspects of memory: Current research and issues* (Vols. 1 & 2). New York: Wiley.

Klatzky, R. L. (1980). *Human memory: Structures and processes* (2nd ed.). San Francisco: Freeman.

Lesgold, A., & Glaser, R. (Eds.). (1989). *Foundations for a psychology of education*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Loftus, E. F. (1979). *Eyewitness testimony*. Cambridge, MA: Harvard University Press.

Martin, J., Cummings, A. L., & Hallberg, E. T. (1992). Therapists' intentional use of metaphor: Memorability, clinical impact, and possible epistemic/motivational functions. *Journal of Consulting and Clinical Psychology*, 60, 143-145.

Martin, J., Paivio, S., & Labadie, D. (1990). Memory-enhancing characteristics of client-recalled important events in cognitive and experiential therapy: Integrating cognitive experimental and therapeutic psychology. *Counselling Psychology Quarterly*, 3, 239-256.

Martin, J., & Stelmaczonek, K. (1988). Participants' identification and recall of important events in counseling. *Journal of Counseling Psychology*, 35, 385-390.

Mayer, R. E. (1989). Models for understanding. *Review of Educational Research*, 59, 43-64.

Nuthall, G., & Alton-Lee, A. (1990). Research on teaching and learning: Thirty years of change. *The Elementary School Journal*, 90, 547-570.

Paivio, A. (1986). *Mental representation: A dual coding approach*. New York: Oxford University Press.

Pressley, M., & Levin, J. R. (Eds.). (1983a). *Cognitive strategy research: Educational applications*. New York: Springer-Verlag.

Pressley, M., & Levin, J. R. (Eds.). (1983b). *Cognitive strategy research: Psychological foundations*. New York: Springer-Verlag.

Resnick, L. B. (1989). Introduction. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 1-24). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Slavin, R. E. (1991). *Educational psychology* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Smith, S. M., & Rothkopf, E. Z. (1984). Contextual enrichment and distribution of practice in the classroom. *Cognition and Instruction*, 1, 341-358.

Tulving, E. (1983). *Elements of episodic memory*. New York: Oxford University Press.

Tulving, E. (1985). How many memory systems are there? *American Psychologist*, 40, 385-398.

Tulving, E., Schacter, D. L., & Stark, H. (1982). Priming effects in word-fragment completion are independent of recognition memory. *Journal of Experimental Psychology: Human Learning and Memory*, 8, 336-342.

VanLehn, K. (1985). *Arithmetic procedures are introduced from examples*. (Tech. Rep. No. 18-ST-03). Palo Alto, CA: Xerox Palo Alto Research Center.

Wood, F., Ebert, V., & Kinsbourne, M. (1982). The episodic-semantic distinction in memory and amnesia: Clinical and experimental observations. In L. S. Cermak (Ed.), *Human memory and amnesia* (pp. 167-193). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Woolfolk, A. E. (1990). *Educational psychology* (4th ed.). Englewood Cliffs, NJ: Prentice-Hall.